$$P(k+1) = \begin{bmatrix} y(k+1) \\ z(k+1) \end{bmatrix} = \begin{bmatrix} 10cos(\frac{(k+1)\pi}{12}) \\ 10sin(\frac{(k+1)\pi}{12}) \end{bmatrix} = \begin{bmatrix} 10cos(\frac{k\pi}{12} + \frac{\pi}{12}) \\ 10sin(\frac{k\pi}{12} + \frac{\pi}{12}) \end{bmatrix} =$$

$$\begin{bmatrix} 10cos(\frac{k\pi}{12})cos(\frac{\pi}{12}) - 10sin(\frac{k\pi}{12})sin(\frac{\pi}{12})) \\ 10sin(\frac{k\pi}{12})cos(\frac{\pi}{12}) + 10cos(\frac{k\pi}{12})sin(\frac{\pi}{12})) \end{bmatrix} =$$

$$\begin{bmatrix} cos(\frac{\pi}{12})y(k) - sin(\frac{\pi}{12}z(k)) \\ sin(\frac{\pi}{12})y(k) + cos(\frac{\pi}{12}z(k)) \end{bmatrix} =$$

$$\begin{bmatrix} cos(\frac{pi}{12}) & -sin(\frac{pi}{12}) \\ sin(\frac{pi}{12}) & cos(\frac{pi}{12}) \end{bmatrix} \begin{bmatrix} y(k) \\ z(k) \end{bmatrix}$$

$$\begin{bmatrix} y(k+1) \\ z(k+1) \end{bmatrix} = \begin{bmatrix} cos(\frac{pi}{12}) & -sin(\frac{pi}{12}) \\ sin(\frac{pi}{12}) & cos(\frac{pi}{12}) \end{bmatrix} \begin{bmatrix} y(k) \\ z(k) \end{bmatrix} + w$$

$$O = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} y(k) \\ z(k) \end{bmatrix} + v$$

$$A = \begin{bmatrix} cos(\frac{pi}{12}) & -sin(\frac{pi}{12}) \\ sin(\frac{pi}{12}) & cos(\frac{pi}{12}) \end{bmatrix}$$

$$C = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\begin{cases} p(k+1) = Tv(k) + p(k) \\ y(k+1) = y(k) + \dot{y}(k)T \\ \dot{y}(k+1) = \dot{y}(k) \end{cases}$$

add noise

$$\begin{cases} y(k+1) = y(k) + \dot{y}(k)T + \frac{T^2}{2}\omega(k) \\ \dot{y}(k+1) = \dot{y}(k) + T\omega(k) \\ z(k+1) = z(k) + \dot{z}(k)T + \frac{T^2}{2}\omega(k) \\ \dot{z}(k+1) = \dot{z}(k) + T\omega(k) \end{cases}$$

$$x(k+1) = \begin{bmatrix} 1 & T & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & T \\ 0 & 0 & 0 & 1 \end{bmatrix} x(k) + \begin{bmatrix} \frac{T^2}{2} \\ T \\ \frac{T^2}{2} \\ T \end{bmatrix} \omega(k)$$

$$y(k) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} x(k) + v(k)$$

$$A = \begin{bmatrix} 1 & T & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & T \\ 0 & 0 & 0 & 1 \end{bmatrix}; \quad B = \begin{bmatrix} \frac{T^2}{2} \\ T \\ \frac{T^2}{2} \\ T \end{bmatrix}$$

$$C = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

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